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The Economics of Vertical Restraints

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Introduction

Since the publication of texts in the 1980s relating to the food manufacturing and retailing sectors in the UK and U.S. (Burns *et al.*, 1983; Marion, 1986), it has become an accepted, stylized fact that the food chain in developed countries can be characterized as a series of vertically inter-related input-output markets stretching from farm input suppliers through to food retailing. A dominant characteristic of the analysis conducted by agricultural economists in this area has been the focus on the horizontal structure and behavior of specific stages of the system, in particular food manufacturing and retailing. This research has either followed the structure/conduct/performance (SCP) tradition (see Connor *et al.*, 1985), or, more recently, has been based on the so-called New Empirical Industrial Organization (NEIO) approach which emphasizes the direct estimation of market power using structural models (Perloff, 1992).

In contrast, a good deal less emphasis has been placed on analyzing the vertical aspects of the food chain. This is not to say that such aspects have been ignored. U.S. researchers have concerned themselves for many years with the issue of vertical coordination in the food chain, defined by Mighell and Jones (1963) as:

> "....the general term that includes all the ways of harmonizing the vertical stages of production and marketing. The market-price system, vertical integration, contracting and cooperation singly or in some coordination are some of the alternative means of coordination." (p.7)

As the definition suggests, the focus has been on both describing the vertical structure of the food marketing chain, particularly for farming and first-stage processing, and also analyzing the coordination performance of the chain, where performance is judged in terms of whether a vertical marketing system delivers the right quantity and quality of goods to the right place at the right time (see Sporleder, 1992).

As well as the focus on vertical coordination, there has been analysis aimed at explaining the farm-retail price spread. Much of the work in this area has been conducted in the spirit of Gardner's (1975) seminal paper (e.g. Heien, 1980), and the most recent work in this vein has attempted to make a direct analytical connection between horizontal competition in the food manufacturing and retail sectors and the gap between farm-gate and retail prices (e.g. Holloway, 1991). In addition, there has been some analysis of the nature of bilateral market power between adjacent stages in the food marketing system. For example, Burns (1983) and Hamm and Grinnell (1983) have reviewed the nature of inter-relationships between food manufacturers and retailers in the UK and U.S. respectively, while Azzam and Pagoulatos (1990), using techniques from the NEIO, have estimated the extent of oligopsony power in the U.S. meat-packing industry.

However, apart from the above research, there has been little formal analysis of the nature of vertical contractual relations between stages of the food chain. Although Burns refers to the discounting to retailers by food manufacturers in the UK food chain, a practice investigated in 1981 by the Monopolies and Mergers Commission (MMC), and McLaughlin and Rao (1990) have analyzed the product selection behavior by food retailers in the U.S., agricultural economists have not incorporated such aspects of vertical behavior into models of the food system, it generally being assumed that firms in the chain conduct their transactions through arms' length, linear price contracts.

If practices other than simple pricing exist in the food system, it is important to understand their motivation and impact from both a welfare-economic and a policy standpoint. Clearly efficient vertical coordination and, hence, the farm-retail price spread is likely to be affected by the existence of such contractual arrangements. With respect to policy, rigorous

analysis of vertical restraints is relevant both in the context of government regulations concerning competition, and also the effect that vertical arrangements can have on policy-price transmission in the food system.

It should be noted at this point that it would be unfair to claim that agricultural economists have largely ignored vertical market issues, while mainstream economists have researched widely in this area for many years. In fact, until the last decade, vertical market issues received fairly cursory analysis in the industrial economics literature. This was highlighted recently by Vickers and Waterson (1991),

> "...Vertical relationships were once rather a minority interest in industrial economics, as an examination of the older texts on your shelves (or the shelves of your older colleagues or teachers) will show. This is particularly true of the literature on vertical restraints, which is appearing in texts only now, having been formally developed since the mid-1980s. To be sure, these developments built upon earlier analysis and policy debate (for example about resale price maintenance in the UK),..., but there was not the same degree or breadth of concern." (p.445)

The overall purpose of this paper, therefore, is to provide a selective review of some of the important insights from this recent literature, and to suggest how they might be relevant to the ways in which agricultural economists model vertical relations in the food system. Section 1 of the paper defines precisely what is meant by a vertical restraint, and outlines the basic method for analyzing such arrangements in a single manufacturer/single retailer setting. In Section 2, the analysis is expanded to consider more complex vertical structures, while Section 3 reviews the impact of uncertainty on the nature of vertical restraints. Finally in Section 4, the implications of vertical restraints for applied policy analysis will be considered.

1. Basic Analysis of Vertical Restraints

(i) Definition

Normally in economic theory the concern is with contracts that specify linear prices, i.e. there is a simple uniform posted price such that a buyer pays a seller an amount proportional to the quantity purchased. However, in vertical markets, rather more complex, non-linear contractual arrangements are often observed, which are generally known in the literature as *vertical restraints* (Rey and Tirole, 1986a). A number of such restraints are discussed in the literature (see Katz, 1989), legal or otherwise. Most commonly, these are: *two-part tariffs*, which consist of a franchise fee and a linear price; *retail price restraints*, which relate to contracts where limits are placed on the price at which a retailer can sell a manufacturer's good; *exclusive dealing* and *exclusive territories* which are contractual provisions restricting a retailer to carrying only one manufacturer's brand, and the geographical area of sales of that brand(s); and *full-line forcing* which relates to a retailer having to carry the complete range of a manufacturer's goods.

While the existence of such practices has been known for some time, as Mathewson and Winter (1984) note:

> "These restrictions have been a puzzle to economists, a source of contention in antitrust legislation, and a subject relatively unexplored in economic theory." (p.27)

(ii) Single Manufacturer-Single Retailer

The modern theory of vertical restraints can be thought of as a particular class of the *principal-agent* problem (Rey and Tirole, 1986a; Katz), although the theory of vertical restraints goes beyond the usual single principal-single agent problem. Following Stiglitz (1987), the standard principal-agent problem is one where a principal (the manufacturer) is seeking a contract

that will maximize its expected profits, given that the agent (the retailer) undertakes some set of actions to maximize its expected profits given the compensation scheme, and that the agent is willing to undertake the contract (the rationality constraint).

Formally, a generic version of this problem can be written down as follows for the single manufacturer-single retailer case (see Katz). Suppose the manufacturer produces an intermediate good x at a constant unit cost of c_w, the good being sold to a retailer. The retailer then combines x with retailing inputs y at constant unit cost c_r in order to sell a final good. For simplicity, assume that x is also the final good. In conducting this sale, the retailer applies some effort e, say advertising, which generates retailer revenues of $R(x,y,e;\theta)$, where θ is a demand parameter. If the retailer makes the manufacturer a payment of $W(x,y,e,\theta)$, then the retailer's objective function can be written as:

$$\underset{x,y,e}{\text{maximize}} \; \pi_r[R(x,y,e,\theta) - W(x,y,e,\theta) - c_r y,e;\, \theta] \tag{1}$$

Given the agent's actions, the manufacturer earns:

$$\pi_m[W(x,y,e,\theta) - c(x)] \tag{2}$$

Suppose that the manufacturer can make take-it-or-leave-it contract offers, then the basic principal-agent problem is to set a contract that induces the retailer to act in such a way as to maximize the sum of the expected profits of the two levels of the marketing system, and which also enables the manufacturer to appropriate all of these profits. The optimal contract would be one which satisfies the maximand:

$$\underset{T,x,y,e}{\text{maximize}} \; T - c_w x$$

$$\text{subject to } \pi_r[R(x,y,e;\theta) - T - c_r y,e;\, \theta] \geq 0 \tag{3}$$

where $T-c_w x$ represents total expected profits in the system, and the constraint is the retailer's rationality constraint, i.e. the retailer will only accept the contract offered by the manufacturer if it earns at least its reservation level of profits, which have been normalized to zero.

In principle, a manufacturer could offer a contract that specifies the optimal levels of x^*, y^*, and e^* that would maximize the total profits of the vertical system, while appropriating all of these profits for itself. For example, the following contract could be specified:

$$W(x,y,e,\theta) = \begin{cases} G(\theta) \text{ if } (x,y,e) = (x^*,y^*,e^*), \\ G_0, \text{ otherwise} \end{cases} \tag{4}$$

where $G(\theta)$ satisfies $\pi_r[R(x^*,y^*,e^*,\theta) - G(\theta) - c_r y^*(\theta),e^*(\theta);\theta] = 0$, and $G_0 < 0$

i.e. the retailer either receives the reservation level of profits if there is contract compliance, or incurs a penalty. However, as Katz points out, such a contract is highly infeasible, largely because of the monitoring and enforcement costs.

Much of the theory of vertical restraints in fact deals with cases that Rey and Tirole (1986a) have termed *control environments*. These are a class of the principal-agent problem where there is no exogenous uncertainty about the environment when the contract is signed, and so risk aversion on the parts of principal and agent is irrelevant[1]. In a control environment, several variables have to be solved for in the vertical structure, e.g. the quantity of x sold, wholesale and retail prices P_w and P_r, promotional effort e, and franchise fees g. Those variables that can be observed and put in the contract are defined as *instruments*, and the control problem is to achieve a particular *target(s)* using a *sufficient* set of instruments, i.e. the set of instruments

[1] Rey and Tirole (1986a) comment that even in the principal-agent literature, where uncertainty about agent actions is normally assumed, the control problem is usually rather trivial.

that will just maximize vertical profits, where vertical profits are those that would arise either if all variables were costlessly observable and specified in the contract, or the manufacturer were vertically integrated with the retailer (Mathewson and Winter, 1984).

The key to the contractual problem then is the need on the part of the manufacturer to overcome the existence of vertical *externalities* between the two stages of the marketing chain (Rey and Tirole, 1986a; Katz). The actions of one party affects the profits of both manufacturer and retailer, although each party makes decisions only in terms of their own expected profits. This is best illustrated with reference to the well-known issue of double marginalization (Spengler, 1950). As a benchmark, suppose that the manufacturer and retailer were vertically integrated, the price of the final good would be P_r^v which maximizes profits of the vertical system, $\pi^v=(P_r^v-c_w)x$, where, for simplicity, other retailing inputs y, effort e, and the demand parameter θ have been suppressed. In contrast, in the non-integrated structure, the manufacturer could offer a linear price contract $W(x)=P_wx$. Given this contract, the retailer maximizes profits $\pi_r=(P_r-P_w)x$. In addition, the manufacturer charges a wholesale price $P_w>c_w$ in order to maximize profits, which exceeds the transfer price of c_w under vertical integration. Therefore, because of the two marginalizations by manufacturer and retailer, the non-integrated retail price exceeds the integrated price, $P_r>P_r^v$. Essentially, the retailer fails to account for the manufacturer's marginal profit, i.e. there is retailer moral hazard.

In both the vertical restraints and principal-agent literature[2], it is a basic proposition that a simple two-part tariff will resolve this externality without the need for vertical integration. Suppose the retailer is offered a contract $W(x)=g+P_wx$, where $P_w=c_w$, and the franchise fee $g=(P_r-$

[2] See Sappington (1991) for a discussion of the principal-agent literature relating to the sharecropper problem.

c_r)x, so that the retailer is the *residual claimant* of aggregate vertical profits, i.e. the retailer is able to capture any additional vertical profits due to its actions. By charging the retailer the marginal cost of the intermediate input, the retailer is induced to take the decision that maximizes vertical profits, i.e. the franchise fee and the wholesale price are sufficient instruments[3]. Resale price maintenance (RPM) will also resolve the double marginalization issue, because the retail price is fixed at P_r^v, and the intermediate good is also sold at P_r^v, so that the retailer makes zero profit, but the manufacturer appropriates all the vertical profit. Of course, as Katz points out, the above result is contingent on both the legality of two-part tariffs and manufacturer and retailer having complete information about the state of the world. For the moment, both contingencies are assumed to be met. In addition, note that the use of vertical restraints here will generate a Pareto welfare improvement, as the final retail price will be lower.

(2) Further Analysis of Vertical Restraints

(i) Single Manufacturer/Multiple Retailers

Having outlined the basic argument for vertical restraints, the analysis is extended in this section to the case of multiple retailers, following the seminal analysis of Mathewson and Winter (1984, 1986). The results here are based on a standard spatial, retail market structure. On the demand side, suppose consumers are uniformly distributed around a circle with density v, and for every unit of a good purchased, each consumer incurs the same travel cost of t per unit of distance. Each retailer buys the manufacturer's good x at the wholesale price P_w, and applies other retailing inputs y in fixed proportions at constant unit cost c_r, where the good x is produced

[3] This result also holds under uncertainty where the retailer is risk neutral (see Sappington).

at unit cost c_w by a single manufacturer who maximizes profit per unit of distance. At each retail location, effort e is expended in order to inform consumers of the good, and some part of this effort α may spill over into other locations. This effort, which cannot be observed costlessly by the manufacturer, is in the form of advertising, where the total cost of advertising at a density of A over an interval ds is bads, where b is the unit cost of the advertising effort. For a given A, the proportion of informed consumers at a particular location is h(A), where $h'>0$, and $h''<0$, and the number of informed consumers is vh(A).

Once consumers know about the good, they are perfectly and costlessly informed about prices at all retail locations. Average demand per consumer is a function $f(P_r+ts)$, where P_r is the retail price, and s is the distance traveled to the retailer. Each consumer buys the good from the retailer offering the lowest price (P_r+ts). Given free entry into the retail market, equilibrium is where the price and effort level of each equally-spaced firm generates zero profits, where retailers are assumed to have Loschian conjectures, i.e. each retailer assumes adjacent retailers will exactly match their price changes, $\delta P_{rj}/\delta P_{ri}=1$, $i\neq j$[4]. Symmetry implies that $P_{ri}=P_r$, $A_i=A$.

In order to analyze the role of vertical restraints in this type of setting, the retail equilibrium is first derived. Initially assume that $\alpha=0$, i.e. there are no advertising spillovers. For a given price P_r, and level of A, each retailer faces two equal-sized market areas either side of its location, so that its demand function is:

$$x(P,A,R) = 2vh(A)\int_0^R f(P + ts)ds \qquad (6)$$

where R is a radius. Given Loschian conjectures, the profit π_r of a retailer is:

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[4] Mathewson and Winter (1984, 1986) also consider the case of Nash conjectures, which, for brevity, is excluded here.

$$\pi_r = 2[vh(A)(P_r - P_w - c_r)\int_0^R f(P_r + ts)ds - RbA] \quad (7)$$

In equilibrium, the first-order conditions and the free-entry condition are written as:

$$\frac{1}{2}\cdot\frac{\delta\pi_r}{\delta P_r} = vh(A)[P_r - p_w - c_r)\int_0^R f'(P_r + ts)ds + \int_0^R f(P_r + ts)ds] = 0 \quad (8)$$

$$\frac{1}{2}\cdot\frac{\delta\pi_r}{\delta A} = vh'(A)(P_r - P_w - c_r)\int_0^R f(P_r + ts)ds - Rb = 0 \quad (9)$$

$$2[vh(A)(P_r - P_w - c_r)\int_0^R f(P_r + ts) - RbA] = 0 \quad (10)$$

If there are advertising spillovers from one retailer's market area to other retailers' markets, then the first-order condition on advertising becomes:

$$\frac{1}{2}\cdot\frac{\delta\pi_r}{\delta A} = vh'(A)(1 - \alpha)(P_r - P_w - c_r)\int_0^R f(P_r + ts)ds - Rb = 0 \quad (11)$$

Given these conditions, the profits per unit distance of a vertically integrated manufacturer are:

$$\pi_m^v = [x(P_r^v,R,A)(P_r^v - c_r - c_w)]/2R - bA \quad (12)$$

Given free entry into retailing, expression (12) can also be treated as the level of profits that a non-integrated manufacturer could receive as a function of the target variables (P_r,R,A), where the relevant instrument is the wholesale price P_w. The optimal values of P_r^*, R^* and A^* that would maximize (12) for the manufacturer are as follows:

$$R\cdot\frac{\delta\pi_r}{\delta P_r} = vh(A)[P_r - c_w - c_r)\int_0^R f'(P_r + ts)ds + \int_0^R f(P_r + ts)ds] = 0 \quad (13)$$

$$R^2.\frac{\delta\pi_m}{\delta R} = vh(A)(P_r - c_w - c_r)[Rf(P_r + tR) \int_0^R f(P_r + ts)ds] = 0 \qquad (14)$$

$$R.\frac{\delta\pi_m}{\delta A} = vh'(A)(P_r - c_w - c_r)\int_0^R f(P_r + ts)ds - Rb = 0 \qquad (15)$$

Just as in the single manufacturer/single retailer case, Mathewson and Winter (1984) show that a simple linear price contract with respect to the wholesale price will not be sufficient to maximize the profits of the vertical system. Focusing first on prices set by the manufacturer and the retailers, because the manufacturer is a monopolist, it sets prices in excess of unit cost, $P_w>c_w$, and given that $f'<0$, then the left-hand side of (13) is negative, given that the retailers set $P_r>P_r^v$. In addition, retailers advertise too little, so that the left-hand side of (15) is positive, an effect that is increased when there are advertising spillovers in retailing. The intuition of this result is straightforward. When retailers set the final price for x and expend effort on advertising, they know that either lowering the retail price or/and advertising more will result in the manufacturer appropriating the increase in profits due to the fact that the wholesale price exceeds the manufacturer's costs, i.e. the retailers are not the residual claimants.

In the case of no advertising spillovers, Mathewson and Winter (1984) show that a two-part tariff will be a sufficient instrument to remove the vertical externality. As before, each retailer is offered a contract $T(x)=g+P_wx$, where $P_w=c_w$ and g is the franchise fee. The zero-profit condition for each retailer now becomes:

$$2[vh(A)(P_r - P_w - c_r)\int_0^R f(P_r + ts) - RbA] - g = 0 \qquad (16)$$

Thus setting $P_w=c_w$ in the profit constraint (16), and also in the pricing and advertising first-order conditions (8) and (9), means that the retailers' behavior coincides with the manufacturer's best profit outcome as given by (13) and (14). Essentially, the wholesale price set at cost c_w induces the retailers to set the optimal retail price and advertising levels, and the manufacturer appropriates the profits through the franchise fee. The consumer will also benefit from lower retail prices.

In the case of advertising spillovers, the manufacturer will have to use both a franchise fee and RPM. This follows from the fact that even if the manufacturer sets $P_w=c_w$, the retailers will still advertise too little when $\alpha>0$. Therefore, in this case, the manufacturer simultaneously sets a wholesale price $P_w<c_w$ in order to induce more advertising, and, because the retail price will be too low, specifies the optimal retail price P_r^*, and extracts the profits with the franchise fee. Again, retail prices will be lower, even in the presence of retail price maintenance.

It should be noted here that Shaffer (1991a) has shown that a two-part tariff will not be a sufficient instrument when the manufacturer sells more than one brand of the good, and there is limited retail-shelf space. When there are multiple brands, the retailer may be able to exert bargaining power through brand selection. As a result, *strategic* rents may be gained from setting one good against another, as well as the *scarcity* rents from shelf space. The former refers to the opportunity cost of carrying an extra brand, measured in terms of reduced sales of substitute brands, while the latter are the foregone profits from the most preferred excluded brand.

Essentially, extra brands of a good will only be carried if their incremental profit is non-negative, i.e. a brand will be dropped if it results in foregone profits due to a reduction in sales of substitute brands. If a retailer is unwilling to accept rents less than the opportunity cost of any

brand carried, brand-specific two-part tariffs will only result in the appropriation of the marginal contribution to retailer profits of a particular brand not all the strategic rent. Shaffer (1991a) shows that other vertical restraints will have to be adopted by the manufacturer in order to satisfy the sufficiency argument. *Full-line forcing* would be a sufficient constraint as the retailer is simply forced to carry the complete range of brands and is then charged a two-part tariff for each brand. Given that such a practice may be illegal, other restraints such as *brand discounts* and *aggregate rebates* can achieve the same objective. For example, with brand discounts, rather than specifying brand-specific contracts, the manufacturer charges a wholesale price equal to marginal cost and sets fees for each brand stocked singly, but gives a fee discount for the multiple stocking of brands, which reduces the retailer's benefit to the scarcity rents. Aggregate rebates will achieve the same objective, where the rebate is given for stocking the range of brands. Interestingly, both brand discounts and aggregate rebates were covered in the MMC report (1981) on vertical behavior in the UK food chain.

(ii) Multiple Manufacturers/Multiple Retailers

A characteristic of the analysis outlined so far is that the use of vertical restraints is aimed at removing vertical externalities such as the double marginalization problem, and will, therefore enhance efficiency. However, it is also possible that vertical restraints may be aimed at reducing competition at either the manufacturing or the retailing level, and hence, may not be socially desirable if collusion is *facilitated* at either one or both levels (Rey and Stiglitz, 1988). In order to illustrate this point, a result due to Bonanno and Vickers (1988) is outlined. Consider a situation where manufacturing consists of a duopoly selling differentiated goods to a downstream duopoly retailing sector[5]. Two situations are dealt with, one where each manufacturer delegates

[5] The model does generalize to an n-firm oligopoly, the assumption of duopoly being made simply for diagrammatic convenience.

manufacturer delegates one retailer to sell their good (i.e. exclusive dealing), but the retailers compete with each other, the other where a two-part tariff is used by the manufacturers to induce collusion amongst the retailers.

If P^{ri} is the price of good x^i at retail, i=1,2, the demand function can be denoted as $x^{ri}(P^r)$, where P^r is the vector of retail prices $P^r=(P^{r1},P^{r2})$. Standard assumptions are made about these functions:

- first, demand for good i is decreasing and concave in price:

$$x_i^{ri}(P^r) < 0, \quad \text{and} \quad x_{ii}^{ri}(P^r) \leq 0, \qquad i = 1,2 \tag{17}$$

where subscripts refer to partial derivatives with respect to price

- second, the goods are substitutes, albeit imperfect substitutes[6]:

$$x_j^{ri}(P^r) > 0\ , \qquad i = 1,2 \tag{18}$$

If a Nash equilibrium in prices is taken to be the solution concept, then these assumptions will be sufficient to ensure a unique equilibrium.

The vertical market relationship consists of a two-stage game where at the first-stage, each food manufacturer sets a wholesale price and in the second-stage, each retailer sets a retail price. Focusing on the first-stage of the game, manufacturers set per unit wholesale prices P^{wi}, which then become retailers' per unit costs, other retailing costs being ignored for simplicity. Assuming constant unit costs of production c^{wi}, manufacturers' profits are:

$$\pi^{mi} = (P^{wi} - c^{wi})x^{ri}(P^r) + g^i\ , \quad \pi^{mi} \geq 0, \qquad i = 1,2 \tag{19}$$

where g^i is a franchise fee.

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[6] If the goods were independent, then the double marginalization problem would exist for the duopoly.

In the second-stage of the game, retailers set prices. Given wholesale prices P^{wi}, retailers' profits will be:

$$\pi^{ri}(P^r;P^{wi}) = (P^{ri} - P^{wi})x^{ri}(P^r) - g^i, \qquad i = 1,2 \tag{20}$$

If the following assumptions are made about retailers' profits:

$$\pi^{ri}_{ii}(P^r;P^{wi}) < 0, \qquad i = 1,2 \tag{21}$$

$$\pi^{ri}_{ij}(P^r;P^{wi}) > 0, \qquad i = 1,2 \tag{22}$$

$$\pi^{ri}_{ii}(P^r;P^{wi}) + \pi^{ri}_{ji}(P^r;P^{wi}) < 0, \qquad i = 1,2 \tag{23}$$

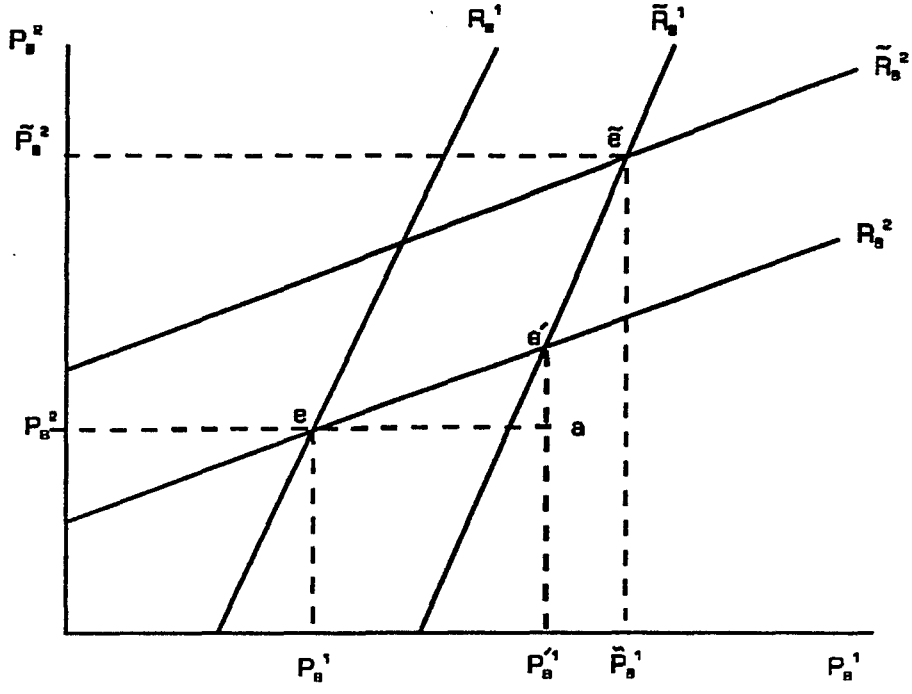
where (21) ensures profit maximization, (22) implies upward-sloping reaction functions, and (23) implies stability of the equilibrium, there will be a Nash equilibrium in retail prices, equivalent to the normal Bertrand outcome.

Assume initially that the franchise fee g^i is zero, and that each manufacturer sets a wholesale price P^{wi} equal to marginal cost. Given this, neither food retailer can credibly raise the retail price P^{ri} beyond the Nash level as they will be undercut by the other firm, the standard Bertrand result. This result is illustrated in **Figure 1**. R^i_B are the initial retailer reaction functions, giving the Bertrand-Nash equilibrium at e. For analytical purposes, these are drawn for the case of retail prices equal to marginal cost which coincides with the case of efficient transfer prices when a manufacturer and retailer are vertically integrated.

However, setting the instrument of a linear wholesale price equal to marginal cost does not maximize vertical profits, because of competitive pricing by the retailers. Suppose that manufacturer 1 raises its wholesale price beyond marginal cost. This shifts retailer 1's reaction function to $\tilde{R}^1_B$, the new Bertrand-Nash equilibrium being at e′. This raises retailer 1's profits

which are appropriated by manufacturer 1 through the franchise fee. Given the nature of the stage-two game, it is also optimal for manufacturer 2 to set a two-part tariff with a higher price, shifting retailer 2's reaction function to $\tilde{R}_B^2$, the new equilibrium being at $\tilde{e}$, the franchise fee being used to appropriate the increased profits of retailer 2. Therefore, in this case, the sufficient vertical restraint is more profitable than vertical integration. In addition, the reduction in competition at retailing is welfare reducing[7].

Figure 1: Food Retailing Duopoly



It is interesting to digress here and use the above type structure to rationalize another observed vertical restraint in the food marketing system, *retailing allowances*, i.e. negative franchise fees. Retailing allowances are essentially financial incentives being paid by food

[7] In Rey and Stiglitz's (1988) model, the vertical restraint is that of each retailer selling each manufacturer's product under an exclusive territories contract. This has the effect of reducing intra-brand competition, resulting in higher retail prices, the increased profits being appropriated with a fixed fee.

manufacturers to retailers in order to induce the latter to provide shelf space for and promote the sale of the manufacturers' goods. Such retailing payments are variously referred to as *slotting allowances*, *display allowances*, *placement allowances*, *billing allowances*, *promotional allowances*, or *merchandising allowances*[8]. These may be payments in cash or in kind, e.g. free goods. Regardless of the form, their salient characteristic is, they are lump-sum rather than per unit payments. Even so, the payments may be repetitive, i.e., tied to new good introductions, re-introduction of old goods previously removed from a retailer's shelf, or periods of special market promotions such as end-aisle display, and local newspaper advertising.

Shaffer (1991b) provides an analysis of these allowances using a model similar to that of Bonanno and Vickers. Consider a situation where a competitive manufacturing sector sells homogeneous goods to a downstream retailing duopoly that is differentiated by factors such as location, sales personnel etc. The vertical market relationship consists of a two-stage game where at the first stage, each manufacturer sets a wholesale price and in the second stage, each retailer chooses a manufacturer as supplier and then sets a retail price. In contrast to the Bonanno and Vickers' model, there is now direct competition between manufacturers for shelf-space such that they must set a price that leads to a retailer earning at least as much in profit as implied by other manufacturers' prices.

Given the same conditions on demand and profits functions, with g^i set to zero, the resultant equilibrium of the two-stage game will be sub-game perfect[9], i.e. manufacturers cannot

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[8] Trade sources in the U.S. suggest that such allowances account for between a third and a half of total promotional expenditures by food manufacturers (Advertising Age, 1987). The MMC also note similar types of arrangement in the UK (1981, p.15).

[9] A sub-game perfect equilibrium is one where a set of strategies for each player comprises a Nash equilibrium for the entire game and every sub-game. It essentially rules out non-credible threats.

raise wholesale price P^{wi} beyond the Nash level of marginal cost, as the other firms will offer retailers a lower wholesale price, and neither retailer can raise the retail price P^{ri} beyond the Nash level as they will be undercut by the other firm.

Suppose, however, that franchise fees are allowed. A manufacturer can now offer a retailer an observable[10] two-part tariff contract, which, in equilibrium, will constitute a higher wholesale price than previously, and a negative franchise fee, i.e. a retailing allowance[11]. The food retailer, facing a higher wholesale price, can credibly commit to paying this, because the lost revenue per sale is recouped through the retailing allowance. However, in committing to pay the higher wholesale price, competition is lessened at the retail level, as the other retailer raises price which feeds back into higher profits.

This result is described in **Figure 1**, where the direct and indirect effects of the contract are shown. e is again the initial equilibrium, and if a manufacturer supplying retailer 1 raises price above marginal cost, the new equilibrium is at e′. Retailer 1 can credibly raise price if the processor pays a fee that compensates for the direct effect of the loss of profits at point a. The indirect effect follows from the fact that as retailer 1's reaction function has been shifted, retailer 2 will also charge a higher price. Again, it will be optimal for both all manufacturers to offer this two-part tariff so that the new equilibrium is at ẽ. Essentially, the same result is generated as in the Bonanno and Vicker's case, except that it is retailers who appropriate the rents.

Shaffer (1991b) also provides another result in his paper that highlights the possible inconsistency of anti-trust policy with respect to vertical restraints. Essentially, he shows that

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[10] If contracts were not observable, the game collapses to that without fixed fees.

[11] It is assumed that if the slotting allowance is paid, the relevant manufacturer can contractually assure that his good will be purchased by the retailer, i.e. cheating by the retailer is ruled out.

RPM will be less harmful to welfare than retailing allowances. Given the structure of the game, the intuition for this result is straightforward: as manufacturers aim to maximize the profits of retailers, if both retailers are offered contracts with RPM, then each manufacturer will have to specify the retail price that would occur in the absence of either RPM or retailing allowances, i.e. e in **Figure 1.** If, however, only retailer 1 is offered a contract with RPM, then e´ can be achieved, which effectively means retailer 1 acts as a Stackelberg price leader, while retailer 2 is a price follower, and the manufacturer(s) not using RPM has no incentive to set the wholesale price in excess of marginal cost, because retailer 2 will simply want to maximize profits. Clearly, prices and profits increase with asymmetric RPM, however, this strategy is Pareto-dominated by retailing allowances where prices and profits are higher. The inconsistency in U.S. anti-trust policy is that while RPM is *per se* illegal, retailing allowances are not.

(3) Uncertainty and Vertical Restraints

As noted in Section 1, much of the theory of vertical restraints assumes uncertainty when contracts are signed. However, if there is uncertainty about either the environment or actions taken by the retailer, an important feature of the delegation problem is ignored which may affect both the private and social ranking of vertical restraints. In particular, certain restraints may prevent retailers from utilizing efficiently the information they have, and may fail to give them sufficient insurance.

To get a sense of the role of uncertainty, the framework developed in Rey and Tirole (1986a, 1986b) and Tirole (1989) is outlined. Consider a vertical market structure where a single, risk-neutral manufacturer produces good x at constant unit cost c_w, which is supplied to

a retailing sector made up of two firms chosen from a competitive supply of retailers. The retailers, who are either risk-neutral or risk-averse, combine good x with other retailing inputs y at a constant cost unit c_r, demand for x being given by the function $x(P_r,\theta)=\theta-P_r$, where θ is a demand parameter. In setting a contract, the manufacturer can observe the wholesale price P_w and the amount of x delivered to the retailer, but the demand parameter θ and retailing costs c_r cannot be observed. In contrast, the retailer may get information about θ and c_r after the contract is signed. As a result of this information asymmetry, there may be retailer moral hazard.

Given this setting, the focus is on three possible vertical market arrangements. First, if there is Bertrand competition between the retailers, then, whatever the state of nature, the retail price $P_r=(c_r+P_w)$ in equilibrium, franchise fees are zero and the manufacturer charges a wholesale price that would induce the retail monopoly price. Second, the manufacturer could assign exclusive territories to the retailers, and charge a wholesale price $P_w=c_w$ so that each retailer acts as a monopolist in its assigned market, the rents being appropriated with a fixed fee. Third, the manufacturer could use RPM to set the retail price at the monopoly level, sell the good x at marginal cost c_w, and extract the rents with a franchise fee. Obviously, the degree of delegation varies across these different arrangements, but in the absence of uncertainty, they generate the same profit and welfare outcome.

With uncertainty, these restraints are not necessarily equivalent. In the case of retailer risk neutrality, the manufacturer would prefer the arrangement of exclusive territories to either competition or RPM. With exclusive territories, the manufacturer maximizes expected vertical profits by charging a wholesale price $P_w=c_w$, and then delegates the pricing decision to the retailer who can adapt to uncertainty without being constrained either by the manufacturer, as in the case

of RPM, or the other retailer in the case of competition. In contrast, neither RPM nor competition are as effective at achieving this objective. In the case of competition, the retail price is entirely determined by cost, and is unresponsive to the demand parameter θ, while for RPM, the retail price is fixed before the uncertainty is resolved, and so is not adapted to either cost or demand conditions.

In the case of retailer risk aversion, there is a need to provide the retailer with some insurance, because any increase in retailer risk reduces the level of the franchise fee that the manufacturer can set. It turns out that competition is likely to be the most preferred arrangement. This results from the fact that Bertrand competition provides perfect insurance under both cost and demand uncertainty, i.e. neither retailer makes positive profits. RPM also provides perfect insurance in the case of demand uncertainty if the retailer cost c_r is known, because the manufacturer can force the level of retailer profits to zero, however, with uncertainty about c_r, RPM provides no insurance to the retailer, and will, therefore, be dominated by competition and exclusive territories. In the case of exclusive territories with demand uncertainty, if the wholesale price is set equal to wholesale costs, the retailer bears all the risk, and, therefore, the manufacturer has to raise the wholesale price in order to reduce the extent of retailer profit risk.

It also turns out that uncertainty and the degree of retailer risk aversion affects the welfare outcome for consumers, in particular, competition is always preferred to exclusive territories. Compared to the situation of certainty, where both restraints result in the same welfare outcome as under vertical integration, competition generates higher expected net consumer surplus. This follows from the fact that under competition, retailers get perfect insurance, whereas under

exclusive territories, risk is shared through a wholesale price being set in excess of wholesale cost, which is then passed on in higher average retail prices.

4. Policy and Vertical Restraints

(i) Competition Policy

The previous sections of the paper have treated alternative vertical restraints as if they are all legal. However, it is important to consider briefly their legal status. In the case of the UK, vertical restraints are covered by various pieces of legislation. Price restraints come under the 1976 Resale Prices Act, such that minimum resale price maintenance is essentially *per se* illegal, although maximum resale price maintenance is not. Non-price restraints are dealt with under the 1973 Fair Trading Act, and its extension in the 1980 Competition Act which introduced the concept of anti-competitive practices such as full-line forcing and tie-ins. However, as Hay and Morris (1991) point out, such practices are only ruled on if deemed against the public interest in a monopoly investigation by the MMC, i.e. they are not *per se* illegal. In the U.S., both minimum and maximum RPM have been *per se* illegal since 1975 (see Shaffer, 1991b), and while other vertical restraints have always been condemned under the Clayton Act, Department of Justice guidelines published in 1985 suggest that non-price restraints be removed from the area of policy except in instances where firms have a dominant position (Hay and Morris).

As the selective review of the vertical restraints literature indicates, it is perhaps not surprising that there is no widespread agreement among economists as to whether a particular restraint is socially desirable or harmful, and that there are inconsistencies in policy. Some commentators, particularly from the 'Chicago School', have argued for the *per se* legality of

vertical restraints (Bork, 1978), whereas others argue in favor of a rule of reason because the theory of vertical restraints is ambiguous in terms of its welfare predictions. Katz suggests that the key to good policy design rests with the development of workable means for identifying whether such practices are socially desirable. In addition, such practices should be treated in a consistent manner, e.g. RPM versus slotting allowances.

(ii) Food and Agricultural Policy

The other important aspect of policy and vertical restraints is the impact that they may have on policy-price transmission in the food system. As McCorriston (1994) indicates in his paper, when successive stages of the food chain are imperfectly competitive, and there is product differentiation at retailing, it is possible that changes in farm-gate prices brought about by agricultural and trade policy reform may not be fully transmitted to consumers. However, in terms of vertical market arrangements, the model on which these predictions are based assumes arms' length, linear pricing between downstream stages in the marketing chain. Putting both vertical integration and vertical restraints into this kind of model adds a further twist to the policy-price transmission story. Intuition suggests that two additional propositions about policy-price transmission can be derived, that broadly reflect the expected welfare effects of vertical arrangements:

- first, if there is vertical integration in the food marketing system, pass-through effects will be greater than with no integration, as long as inputs are priced efficiently and the structure of integration does not also involve horizontal integration at any given stage of the marketing system[12], i.e. vertical integration may be expected to remove the inefficiencies of double marginalization.

[12] See Abiru (1988) for a recent discussion of the likely effects of vertical integration in imperfectly competitive markets.

- second, vertical restraints will result in greater pass-through effects than linear pricing if they are aimed at removing vertical inefficiencies, however, if their objective is to facilitate collusion, then the extent of pass-through will be lower than in the absence of restraints.

5. Summary

In summary, vertical restraints have only recently been subject to rigorous analysis by economists, and have received virtually no attention from agricultural economists interested in the food system. However, given that such practices are observed in the food chain, it is relevant to understand their implications for applied policy analysis. Unfortunately, while the literature is rich in analysis of such restraints, theory gives us no unambiguous prediction about their private and social effects, and, hence, no agreed approach to their regulation. In particular, there is an important tension between restraints that increase both private and social welfare and those that increase private and lower social welfare. Nevertheless, in modelling the food system, and in analyzing the effects of food and agricultural policy on private and social welfare, such vertical arrangements ought to be accounted for.

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